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ABSTRACT

Schools cannot expect to obtain gains in learner achievement from computer technology if it is not properly implemented. The concerns of teachers in integrating computer technology in the classroom may impact how computer technology is ultimately implemented. This study examined the concerns of elementary school teachers implementing computer-delivered instruction. Data were collected by administering the Stages of Concern Questionnaire (SoCQ) to teachers at four elementary schools in an urban school district. Responses were analyzed for each of the seven stages of concern (i.e., how users perceive an innovation from the time they first become aware of it until they gain mastery of the innovation). The findings of the study support the position that teachers' concerns and perceptions of an integrated learning system (ILS) influence the way in which they implement an ILS. For schools to experience significant change or reform due to the integration of computer technology, the instructional concerns and practices of teachers must be carefully considered. Furthermore, the integration of computer technology must be approved, accepted, and implemented by teachers for computer technology to ultimately impact student learning while reducing instructional costs. (Author/AEF)

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INTEGRATING COMPUTER TECHNOLOGY IN CLASSROOMS: TEACHER CONCERNS WHEN IMPLEMENTING AN INTEGRATED LEARNING SYSTEM

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Abstract: Schools cannot expect to obtain gains in learner achievement from computer technology if it is not properly implemented. The concerns of teachers in integrating computer technology in the classroom may impact how computer technology is ultimately implemented. This study examined the concerns of elementary school teachers implementing computer-delivered instruction. The findings of the study support the position that teachers' concerns and perceptions of an ILS influence the way in which they implement an ILS.

Introduction

The usual expectation associated with the integration of computer technology into instruction is that it will enhance student learning while significantly reducing instructional costs (Green & Gilbert, 1995). Unfortunately, during the last decade the rapid deployment of computer technology in classrooms created several problems. For instance, it was not unusual for a school to install computers and educational software and learners begin to use the computer systems before anyone questioned the implementation of the technology. The problems associated with the implementation of computer technology were intensified when schools lacked adequate funding to train teachers in the appropriate implementation of this technology. The entire process by which computers and learners came together in schools was often "inefficient, poorly planned, and incredibly chaotic" (Maddux, Johnson, & Harlow, 1993, p. 220).

Implementation in schools is the placement of an innovation in the instructional process and is distinguishable from adoption because many innovations are adopted but never implemented (Bond, 1988). Fullan and Pomfret (1977) described implementation as a "phenomenon in its own right" (p. 336) and suggested implementation studies should measure the correspondence of actual use of an innovation with its intended use. Hord and Huling-Austin (1986) cautioned that implementation does not equal delivery of an innovation and that users of an innovation do not necessarily implement an innovation in the way it is intended to be used. Smith and Ragan (1993) advised that "in drawing the line of causation from the instruction to the results, it is critical to be able to identify the degree to which the description of the program represents what actually occurred during instruction with the new program" (p. 416).

The process of educational change and innovation that results from technology integration in classrooms is extremely complex. To deal with this complexity, educational change models often attempt to assess and explain the change process in terms of dimensions or degrees of change. For instance, researchers at the Apple Classroom of Tomorrow (ACOT) project observed distinguishable changes in classrooms in technology-rich schools and regarded instructional changes in ACOT classrooms as an evolutionary process in which teachers moved from concerns about technology to the development of powerful learning experiences for their students (Dwyer, Ringstaff, & Sandholtz, 1991).

Implementation is often difficult and complex due to the variety of curricular programs, computer platforms, and educational populations served by various courseware products. Consequently, schools cannot expect to experience gains in learner achievement and motivation from computer technology if it is not properly implemented. One type of computer-delivered instruction that accounts for a significant share of the educational software market is integrated learning systems (ILSs). ILSs are computer-delivered instruction packaged as comprehensive software systems operating on networked hardware platforms. ILSs provide a

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multi-year curriculum sequence of instruction that is controlled by a management system enabling teachers to assign lesson sequences, monitor learner performance, and generate learner progress reports. (Mills, 1994). ILS appeal seems to be based on the fact that ILSs offer a comprehensive one-stop solution to instructional computing (Robertson, Stephens & Company, 1993). By some estimates, ILSs account for nearly 50% of total educational software purchases (Bailey, 1993).

Several researchers postulated that the way in which users of an innovation perceived the innovation was fundamental to their level of use of the innovation (Fullan & Pomfret, 1977; Hughes & Keith, 1980; Kimpston, 1985). Hughes and Keith reported that an innovation as perceived by the potential user of the innovation and not the innovation itself was the critical variable in explaining the degree of implementation of an innovation. Kimpston reported that "teachers' beliefs and practices about the importance of and participation and involvement in curriculum implementation tasks were more pronounced for teachers who were most closely attending to the curriculum prescribed by the district" (p. 195). Hall, Wallace, and Dossett (1973) postulated that the concerns or attitudes individuals had about a change was an important dimension in the change process.

The role of the teacher in ILS implementation is particularly important because much of the decision-making about how the technology is used is often the responsibility of the individual teacher. In fact, teachers have considerable discretion in determining whether an ILS is even used or not in accomplishing educational goals. The concerns or attitudes that teachers have about the use of an ILS and computer technology in the classroom are fundamental elements in the educational change process and may impact how the technology is ultimately implemented. This study examined the concerns of elementary school teachers implementing ILS technology.

Stages of Concern

Hall, George, and Rutherford (1986) described the concept of concerns about innovations as an aroused state of personal feelings and thought about a particular issue or task and determined that certain demands of an innovation were perceived as being more important than others. Therefore, the type of concern and the degree of intensity about an innovation will vary on the depth of one's knowledge and experience using an innovation.

Stages of concern described how users perceived an innovation from the time they first became aware of it until they gained mastery of the innovation (Hall & Loucks, 1978). Users were initially concerned about how an innovation affected them personally and later became concerned with how the innovation impacted their work environment. A Stages of Concern Questionnaire (SoCQ) was developed from the original conceptualizations provided by Hall et al. (1973). Seven stages of concerns that users or potential users of an innovation had were identified (see Table 1). These stages of concern were distinctive but were not necessarily mutually exclusive (Hord, Rutherford, Huling-Austin, & Hall, 1987). The seven stages varied in intensity and, consequently, characterized the developmental nature of individual concerns.

SELF	0	AWARENESS	Little concern about or involvement with the innovation.
	1	INFORMATIONAL	General awareness and interest in learning more detail.
TASK	2	PERSONAL	Uncertain about the demands of the innovation, inadequacy in meeting those demands, and his or her role with the innovation.
	3	MANAGEMENT	Attention is focused on the processes and tasks of using the innovation and the best use of information and resources.
IMPACT	4	CONSEQUENCE	Attention focuses on the impact on students in sphere of influence.
	5	COLLABORATION	Focus on coordination and cooperation with others using innovation.
	6	REFOCUSING	Focus on exploration of more universal benefits from the innovation including possibility of changes or replacement with alternative.

Table 1: Stages of Concern about an Innovation (Hord et al., 1987)

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The developmental nature of concerns was reflected by grouping the stages into three dimensions: Self, Task, and Impact (Hord et al., 1987). In the early stages of a change effort individuals were more likely to have personal concerns with the change while in the latter stages of usage of an innovation concerns about the task and the impact of the innovation on users became more intense. An individual was likely to have some concerns at all stages. According to Hall et al. (1986) subjects moved from unawareness and nonuse of an innovation into a more highly sophisticated use. Therefore, the intensity of concern was initially high in Stages 0, 1, and 2 and ultimately high in Stages 4, 5, and 6. To interpret the SoCQ, an overall view of the relative intensity of different stages of concern is developed to profile the intensity of the types of concerns among the respondents.

The SoCQ was developed and validated to provide a quick-scoring measure of stages of concern and is applicable to almost any educational innovation. The SoCQ focuses on the concerns of individuals involved in change. In an educational setting teachers are often the focus of change and innovation and so this instrument is generally used by teachers. For this study the SoCQ was adapted to measure the level of concerns of teachers implementing an ILS.

The instrument consists of 35 items that teachers rate using an eight point Likert scale. Percentile tables allow for converting raw scale scores. Percentile scores reflect the relative intensity of concerns by the user of an innovation in a particular stage. Interpretation of the SoCQ is performed by the examination of percentile scores for peak stages, second highest stage, and high stage for groups or individuals (Hall et al., 1986). To substantiate the internal consistency and reliability of the SoCQ for this study, a pilot study of 33 elementary school teachers from five elementary schools implementing an ILS completed the SoCQ. Total test reliability and item-total reliabilities were computed for each of the seven stages of concern scales. The pilot test yielded a coefficient alpha of .90 for the total scale and item-total reliability coefficients for Stages 1-6 were high ($p < .01$) while Stage 0 yielded a reasonably high item-total reliability coefficient ($p < .05$).

Method

To collect data for this study, the SoCQ was administered to all ILS-using teachers in four elementary schools in an urban school district implementing an ILS. Of the 93 teachers in the four elementary schools who were handed a questionnaire, 65 completed and returned the SoCQ for an overall return rate of 71%. Reliability coefficients were computed for each of the seven stages of the SoCQ employing a two-tailed test. The 35-item questionnaire yielded high reliability coefficients for all stages ($p < .01$).

To analyze the SoCQ, data item responses were grouped and summed according to each of the seven stages of concern. Raw scores were converted to percentile scores for each of the stages and response patterns were examined as high and second high stages of concern. Both the second high stage score and the peak stage score were evaluated. Overall, highest levels were at Stage 0 and second highest at Stage 1. Although there was an overall high response tendency among all the stage scores, high Stage 0 scores may indicate either an unconcern about the innovation or users who are more concerned about things not related to the innovation (Hall et al., 1986). Tables 2 and 3 provide matrices of the frequency and proportion of the high and second high stages of concern scores.

STAGE	0 Awareness	1 Informational	2 Personal	3 Management	4 Consequence	5 Collaboration	6 Refocusing	High Stage Total
0 Awareness		12	9	9	1	1	3	35
1 Informational	5		3	0	1	1	0	10
2 Personal	0	4		0	0	0	0	4
3 Management	2	4	3		0	1	0	10
4 Consequence	1	0	0	0		0	2	3
5 Collaboration	1	0	0	0	0		0	1
6 Refocusing	1	0	1	0	0	0		2
2nd High Stage Total	10	20	16	9	2	3	5	65

Select Highest Stage of Concern from left column and read across for Second Highest Stage of Concern.

Table 2: Frequency of Highest and Second Highest Stages of Concern, n=65

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STAGE	0 Awareness	1 Informational	2 Personal	3 Management	4 Consequence	5 Collaboration	6 Refocusing	High Stage Total
0 Awareness		18.5%	13.8%	13.8%	1.5%	1.5%	4.6%	53.8%
1 Informational	7.7%		4.6%	0.0%	1.5%	1.5%	0.0%	15.4%
2 Personal	0.0%	6.2%		0.0%	0.0%	0.0%	0.0%	6.2%
3 Management	3.1%	6.2%	4.6%		0.0%	1.5%	0.0%	15.4%
4 Consequence	1.5%	0.0%	0.0%	0.0%		0.0%	3.1%	4.6%
5 Collaboration	1.5%	0.0%	0.0%	0.0%	0.0%		0.0%	1.5%
6 Refocusing	1.56%	0.0%	1.5%	0.0%	0.0%	0.0		3.1%
2nd High Stage Total	15.4%	30.8%	24.6%	13.8	3.1%	4.6%	7.7%	100.0%

Select Highest Stage of Concern from left column and read across for Second Highest Stage of Concern.

Table 3: Proportion of Highest and Second Highest Stages of Concern, n=65

Stages of Concern Profiles

When scores were considered and viewed by individual school, trends were more obvious and easily interpreted. Therefore, a profile for each school was formulated. These profiles include charting the SoCQ cumulative scores compared to the mean overall trend (see Figure 1).

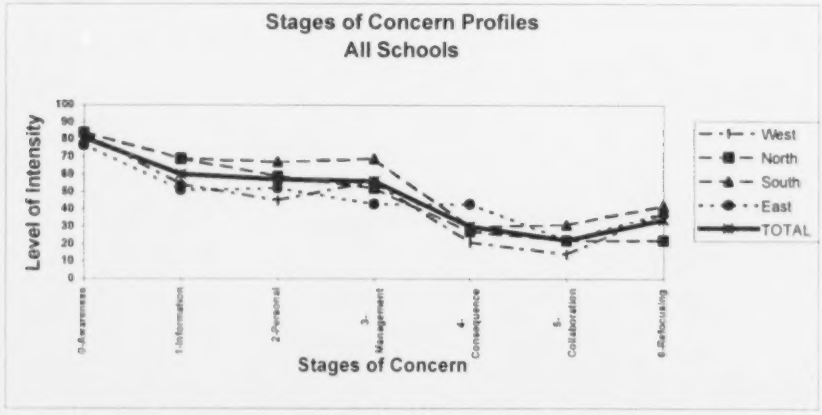

Figure 1: Stages of Concern Cumulative Scores by School and All Schools

West Elementary. A high *Stage 0 — Awareness* indicated established users who were no longer particularly concerned about the innovation (the ILS) or users who were more concerned about things not related to the innovation. The second peak at *Stage 3—Management* suggested that teachers had logistics, time, and management concerns. The tailing-up on *Stage 6—Refocusing* suggested that teachers had ideas about how to improve the use of the ILS. There appeared to be a progression from self concerns (Stages 0, 1, 2) to task concerns (Stage 3). Task concerns are typically more intense during the early period of use of an innovation (Hall et al., 1986).

North Elementary. The SoCQ profile for North Elementary suggested a general awareness and concern about the innovation and an interest in learning more about the innovation (Stage 1 slightly higher than Stage 2). Although a high *Stage 0—Awareness* indicated established users who were no longer particularly concerned about the ILS or were more concerned about things not related to the innovation, a second high *Stage 1—Informational* suggested that teachers wanted more information about the ILS. With the absence of peaking at *Stage 3—Management*, there was no clear indication of progression from self to task concerns. Low *Stage 4—Consequence* and *Stage 5—Collaboration* suggested some lack of concern about consequences for learners. The tailing-off at *Stage 6—Refocusing* revealed no other ideas were competitive with the use of the ILS.

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South Elementary. The profile for South Elementary resembled the profile of West Elementary except at higher levels of stage scores. A high Stage 0 indicated established users who were no longer particularly concerned about the ILS or users who were more concerned about things not related to the ILS. The second peak at *Stage 3—Management* suggested that teachers were transitioning to logistics, time, and management concerns and clearly indicated a progression from self concerns (Stages 0, 1, 2) to task concerns (Stage 3). The distinct tailing-up on *Stage 6--Refocusing* indicated that teachers had ideas about how to improve ILS use.

East Elementary. The SoCQ profile for East Elementary suggested a slightly different spin on the interpretation than that of the other schools due to modest differences in the response pattern. Although a high *Stage 0—Awareness* indicated established users who were no longer particularly concerned about the ILS or were more concerned about things not related to the innovation, *Stage 2—Personal* concerns were equal to or more intense than *Stage 1—Informational*, which suggested users were concerned more about how they were affected personally by the innovation than in learning about the substantive nature of the innovation (Hall et al, 1986). The peaking at *Stage 2—Personal* also suggested that teachers had personal concerns and consequences for themselves. The distinct tailing-up on *Stage 6—Refocusing* clearly indicated that teachers had ideas about how to improve the use of the ILS.

There appeared to be some progression from self concerns (Stages 0, 1, 2) to concerns about the impact of the ILS on learners (Stage 4) based on the peaking that occurred at Stage 4. The difference in the concerns pattern for East Elementary compared to the overall pattern of concerns for all four schools, particularly in regard to *Stage 4—Consequence* concerns, were due, in part, to the fact that this school (both principal and teachers) had been implementing the ILS for a longer period of time than the other schools.

Although the frequencies of highest stage of concern levels were at Stage 0 and second highest at Stage 1, the overall trend for the SoCQ seemed to indicate a slight peaking of concerns at *Stage 3—Management* and then a distinct peaking at *Stage 6—Refocusing*. This pattern would seem to suggest an implementation where, on average, concerns for the innovation were evolving from a dimension of self concerns to a dimension of task concerns. Additionally, the tailing up at Stage 6 supported the notion that the average implementer had ideas about how to change or improve the innovation.

Discussion of the Data Analysis

The developmental nature of individual concerns about the ILS was apparent in both the overall profile, the school profiles, and the individual profiles of the stages of concern. Three of the schools in the study (West, North, and South) had been implementing an ILS for a little less than two years and the fourth school (East) had been implementing an ILS for a little less than three years. This distinction in the length of the implementation period between East and the other three schools was reflected by a progression to a higher level of concerns of East teachers on how the ILS impacts learners.

The teachers in this study most often expressed awareness, informational, or personal concerns. These teachers wanted to know more about an ILS—what an ILS is and how using it affects them. These expressions of concern were typical of a nonuser or inexperienced user. The peaking on *Management* concerns indicated some movement along the concerns continuum from self concerns to task concerns. According to Hord et al. (1987), *Management* concerns become more intense during the early period of use of an innovation. The peaking at *Stage 4--Consequence* concerns by teachers at East Elementary who had been implementing the ILS for a year longer than the other teachers in the study indicated that these teachers were just beginning to be concerned about the impact of the ILS on learners using the ILS.

Regardless of the level of concern about the ILS, most users had refocusing concerns—ideas about improving the ILS that would make it work better. This phenomenon is more indicative of experienced users of an innovation who have used the innovation with efficiency for some time and are concerned with finding better ways to impact learners. One explanation for this phenomenon in this study may be a lack of a basic understanding or knowledge about the ILS that may have been the result of a lack of sufficient training. Rogers (1983) suggested several reasons for re-invention of an innovation that may apply to these findings: (1) the complexity of the innovation, (2) a lack of detailed knowledge about the innovation, (3) an innovation with many possible applications, and (4) an innovation that is implemented to solve a wide range of problems.

The findings of the study support the position that teachers' concerns and perceptions of an ILS influence the way in which they implement an ILS. Implementation of an ILS doesn't happen by itself. ILS implementation is a complex and prolonged process that must be nurtured and sustained. The concerns of users of an ILS change and reformulate over time to reflect a relative intensity that corresponds with the users' level

of experience using an ILS. The reality of organizational change and innovation in schools is its contingency on social conditions and human interactions more than on technological feasibility or cost-benefit (Jaffee, 1998). For schools to experience significant change or reform due to the integration of computer technology in classrooms, the existing instructional concerns and practices of teachers must be carefully considered. Furthermore, the integration of computer technology must be approved, accepted, and implemented by teachers for computer technology to ultimately impact student learning while reducing instructional costs.

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